

**REMARKS**

This is a full and timely response to the outstanding non-final Office action mailed on February 26, 2008. Reconsideration and allowance of the application and presently pending claims are respectfully requested.

**Present Status of the Application**

It has been noted that Applicants' previous arguments with respect to claims 1-8 and 12-14 have been considered but are deemed moot in view of the new grounds of rejection. Besides, the Office has ensured that the US 2006/0051920 reference cited in the previous Office action is not a prior art with respect to the instant application.

Currently, claims 1-8 and 12-14 have been rejected under 35 U.S.C. Section 112, first paragraph, because the specification, while being enabling for the specific first and second cleaning solutions, is deemed not to reasonably provide enablement for non-specified solutions. Claims 7 and 8 have also been rejected under 35 U.S.C. Section 112, first paragraph, because the specification, while being enabling for some of the recited concentrations of the ammonium hydroxide, is deemed not to reasonably provide enablement for the entire claimed range of the ammonium hydroxide. In addition, claims 1-8 and 12-14 directed to the use of ozonated water are deemed not to set forth any steps involved in the method/process, and therefore it seems to be unclear to the Office what method/process Applicants are intending to encompass.

On the other hand, claims 1-8 and 12-13 stand rejected under 35 U.S.C. Section 103(a) as being assertedly unpatentable over the state of the prior art admitted by the Applicants in the specification ("AAPA" hereinafter) in view of Verhaverbeke et al.

(USPAP 2003/0045098; "Verhaverbeke" hereinafter) and Verhaverbeke et al. (USPN 6,491,763; "Verhaverbeke '763" hereinafter). Claim 14 is also rejected under 35 U.S.C. Section 103(a) as being assertedly unpatentable over AAPA in view of Verhaverbeke and Verhaverbeke '763 as applied to claim 1 above, and further in view of Chang (USPAP 2002/0020432; "Chang" hereinafter).

Responsive thereto, claim 1 has been amended to more explicitly describe the claimed invention and to patently define the boundaries of the present invention over the prior art of record. The proposed amendments made to claim 1 are submitted to be supported by the descriptions in paragraphs [0028]~[0031] of the as-filed specification, and therefore it is believed that no new matter has been introduced by way of the amendments to said claim. Claims 7, 9, and 11 have been correspondingly revised along with the amendments made to claim 1 at issue, and claim 14 has been canceled. Upon entry of the proposed amendments and for at least the reasons furnished hereinafter, Applicants respectfully submit claims 1-8 and 12-13 are now in proper condition for allowance and reconsideration of this application is courteously requested.

#### **Discussions of 35 U.S.C. 112 Rejections**

*Claims 1-8 and 12-14 have been rejected under 35 U.S.C. Section 112, first paragraph, because the specification, while being enabling for the specific first and second cleaning solutions, is deemed not to reasonably provide enablement for non-specified solutions. In addition, claims 1-8 and 12-14 directed to the use of ozonated water are deemed not to set forth any steps involved in the method/process, and therefore it seems to be unclear to the Office what method/process Applicants are*

*intending to encompass.*

In response thereto, Applicants have amended claim 1 to recite the specified first cleaning solution as a HF:HCl:H<sub>2</sub>O solution or at least one of H<sub>2</sub>O:H<sub>2</sub>O<sub>2</sub>:NH<sub>4</sub>OH solution and H<sub>2</sub>O:H<sub>2</sub>O<sub>2</sub>:HCl solution, and the second cleaning solution has also be designated as the ozonated DI water, such that the specification is able to enable people skilled in the art to which it pertains, or with which it is most nearly connected, to practice the invention commensurate in scope with claim 1 and its dependent claims. Moreover, the ozonated water of claim 1 has also been specified for rinsing the semiconductor wafer, such that the use of the ozonated water has been indicated in claim 1 at issue with the active and positive step delimiting how this use is actually practiced. Claim 14 has been correspondingly canceled.

Upon entry of the proposed amendments, it is respectfully submitted the aforesaid rejections of claims 1-8 and 12-13 under 35 U.S.C. Section 112, first and second paragraphs, have been overcome.

*Claims 7 and 8 have also been rejected under 35 U.S.C. Section 112, first paragraph, because the specification, while being enabling for some of the recited concentrations of the ammonium hydroxide, is deemed not to reasonably provide enablement for the entire claimed range of the ammonium hydroxide.*

In response thereto, Applicants submit that the lack of enablement in claims 7 and 8 is due to typographical errors and have amended the technical feature “” to “”, as set forth in claim 7. Likely, claim 8 is amended by replacing the technical feature “” with “”. The disclosure of the specification has also been amended for consistency. It should be

appreciated by one skilled in the art that aqueous solution contains an adequate proportion of H<sub>2</sub>O, therefore the proportions in claims 7 and 8 are obvious typographical errors.

**Discussions of the 35 U.S.C. 103(a) rejections**

*Claims 1-8 and 12-13 stand rejected under 35 U.S.C. Section 103(a) as being assertedly unpatentable over AAPA in view of Verhaverbeke and Verhaverbeke '763. Claim 14 is also rejected under 35 U.S.C. Section 103(a) as being assertedly unpatentable over AAPA in view of Verhaverbeke and Verhaverbeke '763 as applied to claim 1 above, and further in view of Chang.* Applicants respectfully controvert the obviousness rejection for at least a *prima facie* case of obviousness has not yet been established by this Office action.

The Office has conceded that AAPA fails to teach the step of cleaning the wafer with ozonated water prior to the RCA cleaning steps, while the Office has still asserted that the use of the ozonated water to remove organic contamination prior to the RCA cleaning was already known in the art as evidenced by Verhaverbeke and Verhaverbeke '763, and asserted that it would have been allegedly obvious to an ordinary artisan at the time the invention was made to include an ozonated water cleaning step prior to the conventional RCA cleaning disclosed by the AAPA with reasonable expectation of success in order to enhance the process because Verhaverbeke and Verhaverbeke '763 assertedly teach such as known to remove organic contamination. Applicants respectfully dissent from said interpretation.

With respect to the currently amended claim 1, it recites the following:

“A semiconductor cleaning method, comprising:

- providing a semiconductor wafer;
- forming a first layer of oxide over the semiconductor wafer;
- forming a floating gate layer over the first layer of oxide;
- forming a second layer of oxide over the floating gate layer;
- etching the first layer of oxide, the floating gate layer, and the second layer of oxide to form a gate structure;
- rinsing the semiconductor wafer including the gate structure using an ozonated de-ionized (DI) water;
- further cleaning the ozonated water-rinsed semiconductor wafer using a first cleaning solution, wherein the first cleaning solution is a  $\text{HF}:\text{HCl}:\text{H}_2\text{O}$  solution or at least one of  $\text{H}_2\text{O}:\text{H}_2\text{O}_2:\text{NH}_4\text{OH}$  solution and  $\text{H}_2\text{O}:\text{H}_2\text{O}_2:\text{HCl}$  solution; and
- additionally cleaning the further cleaned semiconductor wafer using the ozonated DI water.” (Emphasis added)

As narrated in paragraph [0044], the cleaning method proposed in the present invention does not require preparation of all the solutions used in conventional RCA cleaning, such as a diluted 50:1  $\text{H}_2\text{O}/\text{HF}$  solution. As a result, the present invention provides for a lower cost of ownership for the manufacturing process, in addition to an improved yield and low defect counts.

In the amended claim 1, it is clearly indicated that the ozonated water-rinsed semiconductor wafer is further cleaned with use of a  $\text{HF}:\text{HCl}:\text{H}_2\text{O}$  solution or at least one of  $\text{H}_2\text{O}:\text{H}_2\text{O}_2:\text{NH}_4\text{OH}$  solution and  $\text{H}_2\text{O}:\text{H}_2\text{O}_2:\text{HCl}$  solution. These solutions are different from those used in conventional RCA cleaning, and thus it is distinct that the

solutions used in conventional RCA cleaning are not all required in the cleaning method of the present invention.

As such, it is believed that at least the technical feature "further cleaning the ozonated water-rinsed semiconductor wafer using a first cleaning solution, wherein the first cleaning solution is a **HF:HCl:H<sub>2</sub>O** solution or at least one of **H<sub>2</sub>O:H<sub>2</sub>O<sub>2</sub>:NH<sub>4</sub>OH solution and H<sub>2</sub>O:H<sub>2</sub>O<sub>2</sub>:HCl solution**" set forth in claim 1 at issue is neither taught nor suggested by AAPA, Verhaverbeke, Verhaverbeke '763, or any other prior art of record, rendering the amended claim 1 non-obvious and patentable over the cited references, taken alone or in combination.

In light of the foregoing, it is held that the combination of the prior art references does not teach or suggest each and every element recited in the independent claim 1, and thus the *prima facie* case of obviousness for claim 1 has not yet been established by the Office action. For at least the same reasons, Applicants respectfully submit that claims 2-8 and 12-13 directly or indirectly depending upon the allowable independent claim 1 patently define over the prior art references as well.

Claim 14 has been canceled, and the rejection of claim 14 should thus be rendered moot.

Withdrawal of the rejection under 35 U.S.C. Section 103(a) is accordingly requested in all sincerity.

CONCLUSION

In view of the foregoing, it is believed that all pending claims are in proper condition for allowance. If the Examiner believes that a conference would be of value in expediting the prosecution of this application, he is cordially invited to telephone the undersigned counsel to arrange for such a conference.

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Respectfully submitted,

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